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Farnell

DSG2
SYNTHESIZED SIGNAL GENERATOR

INSTRUCTION BOOK

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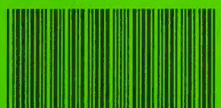
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INSTRUCTION BOOK FOR

DSG2
SYNTHESIZED SIGNAL GENERATOR

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Issue 1. 6.81.

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SCHEDULE OF EQUIPMENT

The instrument has been carefully packed to prevent damage in transit. When removing the unit from the box, be sure to remove all parts and accessories from the packing material.

The complete equipment comprises:

a) Synthesized generator DSG2
b) Mains power supply lead
c) Instruction manual

Optional accessories:

a) IEEE488 interconnection lead, 1 metre
b) b.n.c. to b.n.c. coaxial lead, 1 metre

Note:- In the event of damage in transit or shortage in delivery, separate notices in writing should be given to both the carriers and Farnell Instruments Limited, within three days of receipt of the goods, followed by a complete claim within five days. All goods which are the subject of any claim for damage in transit or shortage in delivery should be preserved intact as delivered, for a period of seven days after making the claim, pending inspection or instructions from Farnell Instruments Ltd., or an agent of this Company.

INTRODUCTION

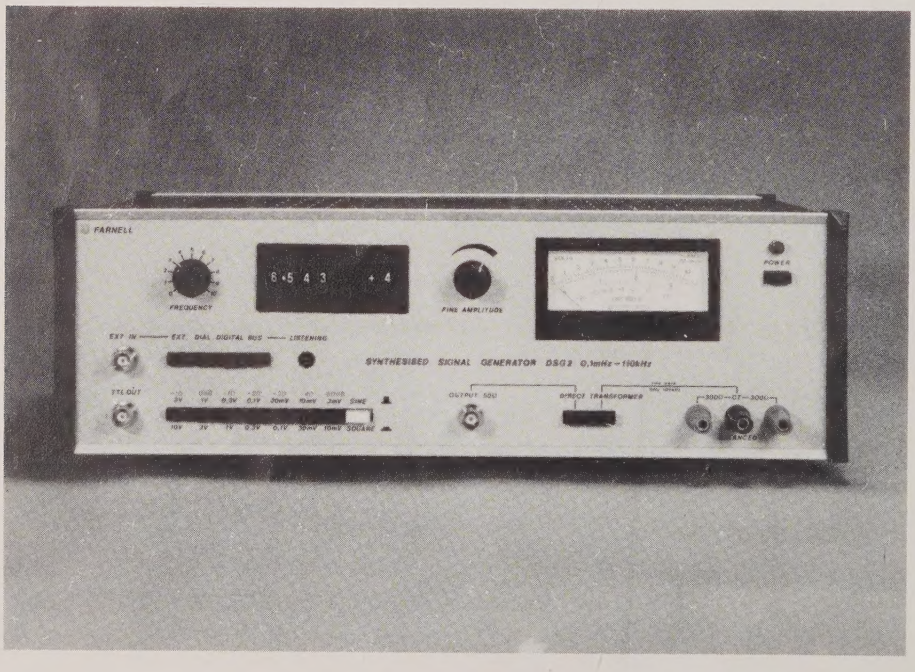
The DSG2 provides sine and square wave outputs from the very low frequency of 0.0001Hz through to 110kHz. Auxiliary outputs give a square wave which is suitable for driving TTL loads, and a similar output at 120 times the output frequency.

The main output is from a 50 ohm source impedance to a front panel b.n.c. socket. Over the audio frequency range a sine wave output is also available via a transformer coupling yielding a balanced 600 ohm impedance output.

The frequency may be adjusted in four different ways. It may be set by the front panel thumbwheel control or by the dial control. It may be altered over a decade range by application of an external voltage or it may be programmed by a computer via the IEEE488 bus.

The output amplitude is continuously adjustable from less than 1mV to 7V r.m.s. (about 20V pk-pk) into open circuit by use of a fine control covering a 20dB range and a precision switched attenuator in 10dB steps. The main output impedance is 50 ohms and the transformer coupled output is 600 ohms.

A meter monitors the output e.m.f. from the DSG2 and is calibrated in V r.m.s. into a matched load, or in V p-p for square wave.



SPECIFICATION

General

The DSG2 is a digitally synthesized signal generator offering sine and square waveform outputs over a wide frequency range, with a TTL compatible output provided separately, as well as the facility on sine wave operation of transformer coupling to provide a balanced output over the frequency range 20Hz to 100kHz. An optionally available IEEE488 (GPIB) interface card provides full programmability of all parameters.

OPERATING TEMPERATURE RANGE

The DSG2 may operate in temperatures between 0°C to 40°C, the following parameters being specified at an ambient temperature of 23°C.

FREQUENCY

Frequency range	0.0001Hz to 109.99kHz, transformer coupled output 20Hz-100kHz.
Frequency selection	One of the following alternatives may be used to set the output frequency. 1. Selected by four thumbwheel switches and a powers-of-ten exponent thumbwheel switch giving range selection. 2. By an uncalibrated front panel potentiometer giving continuous control over greater than a decade range in conjunction with the range selection thumbwheel. 3. By an external d.c. voltage to a front panel socket giving proportionality of output frequency to voltage over the same range as 2 above. 4. By programming input messages from an IEEE488 bus controller (GPIB).
Frequency sweep	Using frequency selection by methods 2 or 3 above range greater than 20:1. External sweep voltage range - 0 to 10V.
Frequency accuracy	±10 p.p.m. on thumbwheel or GPIB operation.
Frequency stability	0.5 p.p.m. per °C, residual f.m. <8Hz at 99.99kHz.

OUTPUTS

Output waveforms	Sine or square wave from main output. Sine wave from transformer coupled outputs, TTL compatible outputs separately available at main output frequency and 120 times this frequency.
Amplitude, unbalanced output	Sine 7.0V r.m.s. (20V pk-pk) max. into open circuit 3.5V r.m.s. (10V pk-pk) max. into 50Ω Square 20V pk-pk max. into open circuit 10V pk-pk max. into 50Ω Source impedance: 50Ω
Amplitude, balanced output	Transformer coupled output, with centre tap, useful in frequency range 20Hz to 100kHz, maximum level 3.5V r.m.s. into matched load. Sine wave operation only.
Output impedance, balanced output	600 ohms with centre tap.
Switched attenuator (externally programmable)	7 steps of 10dB per step - giving a range of +10dB to -50dB relative to 1mW in 600Ω. (8 steps in GPIB mode to -60dBm).
Fine amplitude control	Potentiometer control gives further 20dB of attenuation taking minimum output down to -70dBm.
Attenuator accuracy	±2% down to -30dBm, ±4% down to -60dBm.
Amplitude stability	Better than 0.1%/°C
Output level flatness (frequency response)	50Ω output, sine wave, less than ±0.5dB variation over entire frequency range at half max. amplitude into 50Ω.
Sine wave distortion (digital selection, half max. amplitude into 50Ω)	<0.2% from 1Hz to 9.999kHz <0.4% from 10kHz to 30kHz <0.6% from 30kHz to 1000kHz } from 50Ω output <1.5% from 0.0001Hz to 9.999 x 10^{-1}Hz <0.3% at 1kHz from transformer coupled outputs.
Square wave	Mark-space ratio: 1:1 ±1% Rise & fall times <200ns. Overshoot and perturbation <10%

TTL outputs	A TTL compatible output from a separate front panel BNC connector capable of driving 5 standard TTL loads. A TTL compatible pulse output at 120 x selected frequency, suitable for driving 2 standard TTL loads from the rear panel.
METER	A meter circuit is provided which monitors the output amplifier EMF prior to the attenuator circuit, but is calibrated in terms of voltage into a matched load, scaled as follows. Volts r.m.s. for sine wave Volts pk-pk for square wave Decibel scale, reference 0dB=1mW into 600Ω (sine wave only).
Meter accuracy	±3% of f.s.d.
PROGRAMMING	A remote programming option is available using the standard IEEE488 (GPIB) instrument interface. Using this interface, programming of output frequency in the same format as with the thumbwheel switches is provided. Output amplitude may also be programmed using the 10dB step attenuator, and by an additional 1dB step attenuator included in the option, and in 0.1dB steps, which are also indicated by the meter circuit. The selection between sine or square wave outputs is also programmable.
POWER	Power supply requirement - a.c. mains in range 95-130V or 190 to 260V by rear panel tap change . Connection via standard IEC connector. Consumption 50W max.
MECHANICAL	
Dimensions	385 width x 265 depth x 132 height (mm)
Weight	4.8kg

OPERATING INSTRUCTIONS

Initial setting up

Check that the mains input setting is correct for the local supply by looking through the clear window below the mains input socket on the rear panel.

One of four alternative settings will be visible. Should it be necessary to change the setting, slide the window upwards, remove the fuse and then pull out the small selector card, using the puller provided.

Re-insert the card in the appropriate alternative position so that the required voltage setting is visible when the card is fully replaced. Replace the fuse, ensuring that the rating is correct for the mains voltage to be used, and slide down the window.

Connect a suitable mains plug to the mains cable observing the following colour code:-

Live - Brown
Neutral - Blue
Earth - Green/yellow

Plug the mains cable into the socket on the rear of the instrument and to the power source.

First time operation

Connect a lead from the 50Ω output socket to the input of an oscilloscope. Select DIRECT coupling. Depress the DIGITAL push button and set the thumbwheel switches to 1.000+3, the last two wheels giving positive or negative powers of ten as a multiplier. Turn the FINE AMPLITUDE control fully clockwise and depress the POWER push button. The neon indicator will light and the meter will read approximately full scale.

If the attenuator 3V push button is depressed and the SINE button left out, then a sine wave can be observed on the oscilloscope at a frequency of 1kHz. The output amplitude can be varied by using both the FINE AMPLITUDE control and the attenuator bank.

Frequency setting

There are four modes by which the frequency of the output waveform may be set, they are each considered separately. The desired mode is selected by depressing the appropriate one of the four mode selector switches.

a) DIGITAL

In this mode any desired frequency in the range 1×10^{-4} to 10.999×10^{4} may be set by the thumbwheel switches with a resolution of 1 in 9999, and accuracy better than this. The setting is in the form of a four digit mantissa, and the last two wheels set positive or negative exponents (powers) of ten by which the mantissa is multiplied. It is directly comparable with the 'Scientific' notation used by many calculator manufacturers.

Note:- Operation is only guaranteed for settings of the most significant digit between 1 and 10.

e.g. 93.2kHz = 9.320+4
145Hz = 1.450+2
0.02Hz = 2.000-2

b) DIAL

In the DIAL mode the frequency may be set using the fine FREQUENCY control in association with the two right hand wheels of the thumbwheel selectors, which set the frequency multiplier as in the DIGITAL mode. The scaling round the FREQUENCY control gives the approximate frequency, but is less accurate and less stable than the DIGITAL mode, although it is more useful when a manual sweep of frequency is required.

c) EXTERNAL

The EXTERNAL mode is similar to operation in DIAL mode except that an external d.c. voltage in the range 0 to +10V applied to the EXT IN front panel socket may be used to set the frequency over the decade range which would be covered by the FREQUENCY control in DIAL operation. As in DIAL mode the range multiplier thumbwheels set the decade of frequency over which the frequency may be set by the external voltage. Input resistance to this socket is 10kΩ approx.

d) BUS

The frequency may be set by commands received from a controller over the IEEE488 bus, when this option is fitted. The way in which this is done is described in a separate section - Bus Operation.

Amplitude setting & meter

The output amplitude may be set anywhere in the range 1mV r.m.s. to 7V r.m.s. into open circuit by use of the FINE AMPLITUDE control and the switched attenuator. (1mV to 10V pk for square waves).

The meter circuit monitors the e.m.f. from the output of the generator prior to the attenuator and the transformer. It is calibrated to read the voltage into a matched load scaled by the appropriate setting. The meter reads in Volts r.m.s. for sine wave outputs and Volts pk-pk for the square wave, however the attenuator scaling factor is arranged in such a way that the output from the unit has approximately the same peak to peak output when either SINE or SQUARE is selected. The scaling factors appropriate to SINE operation are shown on the front panel above the buttons and those for SQUARE below. The meter reading takes no account of loads which differ from matched loads i.e. other than 50 ohms for direct coupling and 600 ohms when transformer coupling is used. Nor does it take any account of the response of the transformer, for which reference should be made to the graph on page 15. Voltages across non-matching loads can be calculated using the meter reading, doubling this to give the e.m.f. and the potential division between the load and source resistance. Note: The meter does not function for frequencies less than 1Hz. To ascertain the output level, set up at a frequency between 100Hz and 999Hz then switch to the desired frequency. The amplitude may also be set under control of the GPIB bus, for detailed instructions please refer to the section on Bus Operation.

Transformer coupling

The transformer coupled output provides an isolated balanced source for sine wave signals in the audio frequency range of 20Hz to 100kHz. Square wave signals,while available from these terminals,are not covered by the specification for rise and fall time or overshoot.

The output is predominantly flat between 50Hz and 50kHz when operating into a matched resistive load, but will be different when operating into other loads and open circuit. See graph on page 15.

The output from the transformer should not be floated by more than 50V d.c. or a.c. peak above chassis potential.

Sine/square operation

This is controlled by the white push button at the right hand end of the attenuator switches. When depressed, SQUARE WAVE output is available from the DIRECT output and when the switch is in the 'out' position, SINE WAVE output is available from both DIRECT or TRANSFORMER coupled outputs, according to which is selected.

This waveform selection is also available via BUS CONTROL (see Bus Operation section).

TTL output

A front panel socket provides a square wave output at the frequency to which the DSG2 is set irrespective of whether SINE or SQUARE wave is selected. This output is of a suitable level to drive TTL logic gates with a capability of driving 5 standard TTL loads.

120f output

An output is provided on the back panel at 120 times the frequency to which the DSG2 is set. This output is at TTL level and is only suitable for driving 2 TTL loads. As it is obtained directly from the internal TTL logic, care should be exercised to ensure this output is not overloaded or subject to voltage inputs.

BUS OPERATION

As an alternative to manual operation, the great majority of the front panel functions available to the user of the DSG2 may be controlled remotely by a computer or controller by means of the IEEE488 standard instrument interface (GPIB). Unless requested without, this interface is built into the DSG2 and is ready for use.

Selection of bus operation is achieved manually by the depression of the front panel push-button BUS. The DSG2 must be put into the bus operating mode manually - the GPIB control signal REN is not implemented. Other than that, and selection of the mode of coupling to the output - either transformer coupled or direct, all the parameters of the output signal may be controlled via the GPIB.

Connection and address

There is a standard IEEE488 bus connector socket on the rear panel to which a bus connector lead from the controller should be connected. The DSG2 unit as shipped is internally set to address 9 (a listen only address - ASCII character ')'). Should it prove necessary to change the address, because there is already another instrument on your system using this address, then this should be carried out before connecting power to the unit. The top cover should be removed by slackening the four screws securing the back panel and marked with a white spot. The panel can then move backwards by approximately 5mm allowing the top cover to be slid out of its retaining grooves. This reveals the small bank of address switches mounted on the top most board. Switches 1 to 5 should be adjusted to the binary equivalent of the address required, switch 5 representing the most significant bit. Replace the top cover before use.

Setting the output frequency

The format of the message to be sent over the bus to the DSG2 is the ASCII character F, followed by seven characters which represent the mantissa and exponent of the desired frequency in the following manner:-

F 1. 2 3 4 +2

1st character	- F
2nd character	- numeral between 1 & 9 (note; 0 is invalid) integral part of mantissa*

** To obtain frequencies of 100kHz and above, the first numeric digit can be replaced by the ASCII symbols : or ; or< (characters 58, 59 & 60) which effectively makes leading digits of 10, 11 and 12 available beyond the 9. This involves considerably more dextrous string handling routines in the software to form the message prior to sending. Programming examples are given at the end of the section.*

3rd character - decimal point (full stop) ASCII character 46
4th, 5th, 6th characters - numerals between 0 & 9, the fractional part of the mantissa.
7th character - sign, either + or -, of exponent.
8th character - numeral between 0 & 4, power of ten for mantissa multiplier.

The format of the frequency instruction must be strictly adhered to, it is invalid to have less than or more than one numeric digit before the decimal point, or other than 3 digits after the point, even if they are all zero. Likewise, it is essential that a positive or negative sign precede the exponent digit, a space character will not serve in lieu of a + sign.

The frequency changes to the new frequency the instant the complete message is received by the DSG2.

Setting the output level

The GPIB is used to control the output attenuator in 0.1dB steps. If it is required to set a specific output voltage, then the controllers's software must be used to calculate the attenuation required prior to constructing the message to send to the DSG2 to set the attenuation. The attenuation is set by sending a message in the following format:

A 1 2 3

1st character - A
2nd character - numeral between 0 & 7, tens of dB's attenuation
3rd character - numeral between 0 & 9. units of dB's attenuation
4th character - numeral between 0 & 9, tenths of dB's attenuation

Note - that no decimal point should be used to separate the tenths of decibels from the integral part, unlike in the frequency format. Also, leading zeroes must be present in the format, space characters are not permissible alternatives.

The front panel Fine Amplitude control still has an overriding effect on the amplitude, even when the DSG2 is operated in Bus mode. If precise output voltages are required, then the Fine Amplitude control should be used to set the level to a reference level on the meter, usually the 0dB point, in one of the manual modes, say Digital, at 1kHz. Then, with no attenuation, the output level in Sine wave mode will be +10dBm into 600Ω (i.e. 10mW). The output voltage will be 6V pk-pk (2.45V r.m.s.). To convert a required voltage into a required attenuation this simple conversion formula may be used:

$$\text{Attenuation dBs} \; -20 \log_{10} \frac{(V)}{6}$$

This formula assumes that the required voltage, V, will always be smaller than 2.45V.

Since many computer-controllers do not implement logarithms to the base 10, the conversion formula will work using natural logarithms and dividing the result by the natural logarithm of 10. A convenient programme line in Basic for obtaining the figures for the level programming format in tenths of a decibel is:

```
A = INT (0.5 -200* LOG(V/SQR(6)/LOG (10))
```

The effect of the 0.5 term is to ensure rounding up or down in the usual manner.

Waveshape

The waveshape of the output waveform is easily programmed by a one character message.

C - for sine wave
D - for square wave

Summary of bus instructions

The various Bus instructions may be sent in any order, either together or separately, i.e. if it is required to change the frequency, only the frequency command need be sent, the other parameters will remain unaltered.

For frequency of 32,450Hz	send F3.245+4
For frequency of 12Hz	send F1.200+1
For frequency of 0.075Hz	send F7.500-2
but for frequency of 125,120Hz	send F<.512+4
For attenuation of 10dB	send A100
For attenuation of 77dB	send A770
For attenuation of 3dB	send A030
For attenuation of 0.5dB	send A005
For Sine waves	send C
For Square waves	send D

ASCII & IEEE [GPIB] CODE CHART

B7 B6 B5 / BITS / B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0 0	20 DLE 10 16	40 SP 20 32	60 0 30 48	100 @ 40 64	120 P 50 80	140 ` 60 96	160 p 70 112
0 0 0 1	1 GTL SOH 1 1	21 LLO DC1 11 17	41 ! 21 33	61 1 31 49	101 A 41 65	121 Q 51 81	141 a 61 97	161 q 71 113
0 0 1 0	2 STX 2 2	22 DC2 12 18	42 " 22 34	62 2 32 50	102 B 42 66	122 R 52 82	142 b 62 98	162 r 72 114
0 0 1 1	3 ETX 3 3	23 DC3 13 19	43 # 23 35	63 3 33 51	103 C 43 67	123 S 53 83	143 c 63 99	163 s 73 115
0 1 0 0	4 SDC EOT 4 4	24 DCL DC4 14 20	44 $ 24 36	64 4 34 52	104 D 44 68	124 T 54 84	144 d 64 100	164 t 74 116
0 1 0 1	5 PPC ENQ 5 5	25 PPU NAK 15 21	45 % 25 37	65 5 35 53	105 E 45 69	125 U 55 85	145 e 65 101	165 u 75 117
0 1 1 0	6 ACK 6 6	26 SYN 16 22	46 & 26 38	66 6 36 54	106 F 46 70	126 V 56 86	146 f 66 102	166 v 76 118
0 1 1 1	7 BEL 7 7	27 ETB 17 23	47 ' 27 39	67 7 37 55	107 G 47 71	127 W 57 87	147 g 67 103	167 w 77 119
1 0 0 0	10 GET BS 8 8	30 SPE CAN 18 24	50 (28 40	70 8 38 56	110 H 48 72	130 X 58 88	150 h 68 104	170 x 78 120
1 0 0 1	11 TCT HT 9 9	31 SPD EM 19 25	51) 29 41	71 9 39 57	111 I 49 73	131 Y 59 89	151 i 69 105	171 y 79 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 * 2A 42	72 : 3A 58	112 J 4A 74	132 Z 5A 90	152 j 6A 106	172 z 7A 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 + 2B 43	73 ; 3B 59	113 K 4B 75	133 [5B 91	153 k 6B 107	173 { 7B 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 , 2C 44	74 < 3C 60	114 L 4C 76	134 \ 5C 92	154 l 6C 108	174 ¦ 7C 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 - 2D 45	75 = 3D 61	115 M 4D 77	135] 5D 93	155 m 6D 109	175 } 7D 125
1 1 1 0	16 SO E 14	36 RS 1E 30	56 . 2E 46	76 > 3E 62	116 N 4E 78	136 ^ 5E 94	156 n 6E 110	176 ~ 7E 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 / 2F 47	77 UNL ? 3F 63	117 O 4F 79	137 UNT _ 5F 95	157 o 6F 111	177 RUBOUT (DEL) 7F 127
	ADDRESSED COMMANDS	UNIVERSAL COMMANDS	LISTEN ADDRESSES		TALK ADDRESSES		SECONDARY ADDRESSES OR COMMANDS	

KEY octal 25 PPU / NAK / hex 15 21 — GPIB code, ASCII character, decimal

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READY.

SPECIMEN COMPUTER PROGRAM

```
5 PRINT"■"
7 CLOSE5:OPEN5,5
10 DIM N(15)
20 PRINT"■■REQUIRED FREQUENCY    ■■■■■";
30 INPUTQ$ : IF Q$<>"■" THEN F2=VAL(Q$)
40 GOSUB200
50 PRINT"■■REQUIRED OUTPUT VOLTAGE    ■■■■■";
55 INPUTQ$ : IF Q$<>"■" THEN L2=VAL(Q$)
56 PRINT"■■SINEWAVE OR SQUARE-WAVE (C OR D)    ■■■■■";
57 INPUT Q$:IF Q$<>"■" THEN W$=Q$
58 L3=1 :IF W$="D" THEN L3 =SQR(10)
60 L1=INT(200*LOG(2.44949/L2*L3)/LOG(10))
65 IFL1<0 THEN L1=0
66 IFL1>799 THEN L1=799
70 L1$=STR$(L1)
72 L1$=RIGHT$(L1$,(LEN(L1$)-1))
74 X=LEN(L1$):IF X=3 THEN GOTO 80
76 L1$="0"+L1$:GOTO74
80 M$="F"+F1$+E$+"A"+L1$+W$
90 PRINT "■■■MESSAGE SENT ON BUS ";M$
95 PRINT#5,M$
96 PRINT"■■PRESS RETURN FOR MORE OR T FOR TUNE  ■■■■■";
98 INPUT Q$:IFQ$="T" THEN GOTO500
100 GOTO20
200 REM MESSAGE FORMING S-R
210 E=-5:M$=""
220 F1=F2*10000
230 E=E+1:F1=F1/10
240 IF INT(F1)>0 THEN GOTO 230
250 F1=F1*10:F1$=LEFT$(STR$(F1),6)
252 IF LEN(F1$)>5 THEN GOTO 260
253 IF MID$(F1$,3,1)<>"."THEN F1$=F1$+"."
254 Z=6-LEN(F1$):FORL=1TOZ
255 F1$=F1$+"0"
256 NEXT L
260 F1$=RIGHT$(F1$,5)
270 E$=RIGHT$(STR$(E),2)
280 IF E=>0 THEN E$="+"+RIGHT$(E$,1)
290 RETURN
```

MUSIC DEMONSTRATOR PROGRAM

```
500 FOR K=1TO13
510 N(K)=440*21((K-1)/12)
520 NEXTK:N(0)=0
530 READT1
540 IF T1<0 THEN650
550 L1$="A001"
560 IF T1<1 THEN L1$="A680"
570 IF T1>0 THEN F2=N(T1)
580 GOSUB200
590 PRINT"F"+F1$+E$+L1$+"D"
595 PRINT#5,"F"+F1$+E$+L1$+"D"
600 FOR L=1TO300:NEXTL
605 PRINT#5,"A680"
610 GOTO530
650 PRINT#5,"A680"
690 END
700 DATA 5,3,1,0,5,3,1,0,8,6,6,5,0
710 DATA 8,6,6,5,0,8,13,13,12,10,12,13,0
720 DATA 8,8,0,8,13,13,12,10,12,13,0
730 DATA 8,8,0,8,13,13,12,10,12,13,0
740 DATA 8,8,0,6,5,0,5,0,1,-2
```

READY.

Attenuation Program

Frequency Program

Cursor control characters on PET -these provide for rapid repetition when 'MORE' is requested, since pressing RETURN will substitute the previous setting as default value.

DSG2 set to bus address 5

Calculates attenuation required

Ensures limits are not exceeded

Places leading zeros as required

Outputs message on the bus

E is exponent

Scales frequency down to standard 'scientific' format

Places decimal point and trailing zeroes when needed

Truncates string of excess decimal places

Places sign before positive exponent

Fills array N with notes of an octave

Reads note to be played next

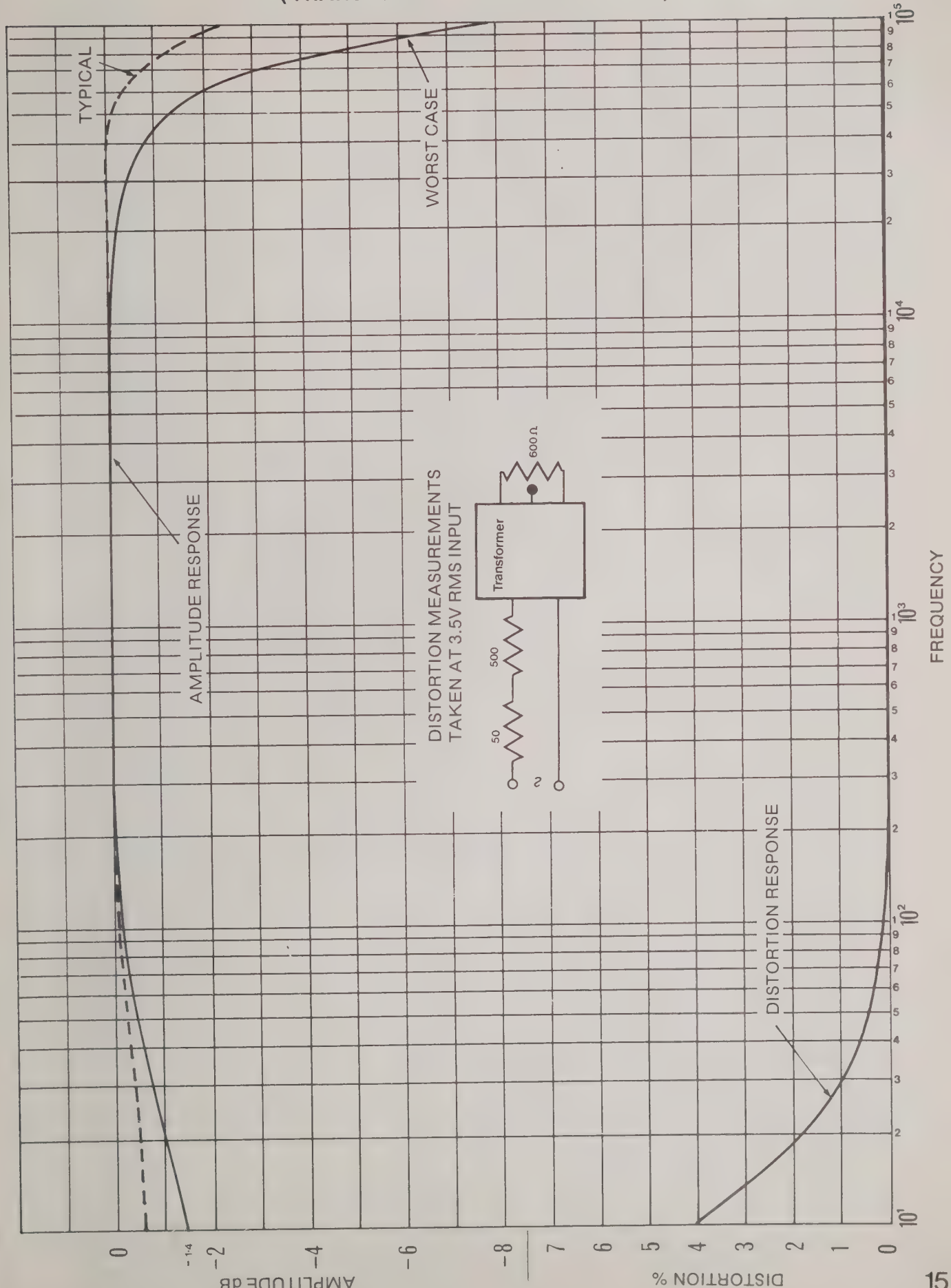
Looks for end

Note 'o' implies a break

Sends message on bus

Music score

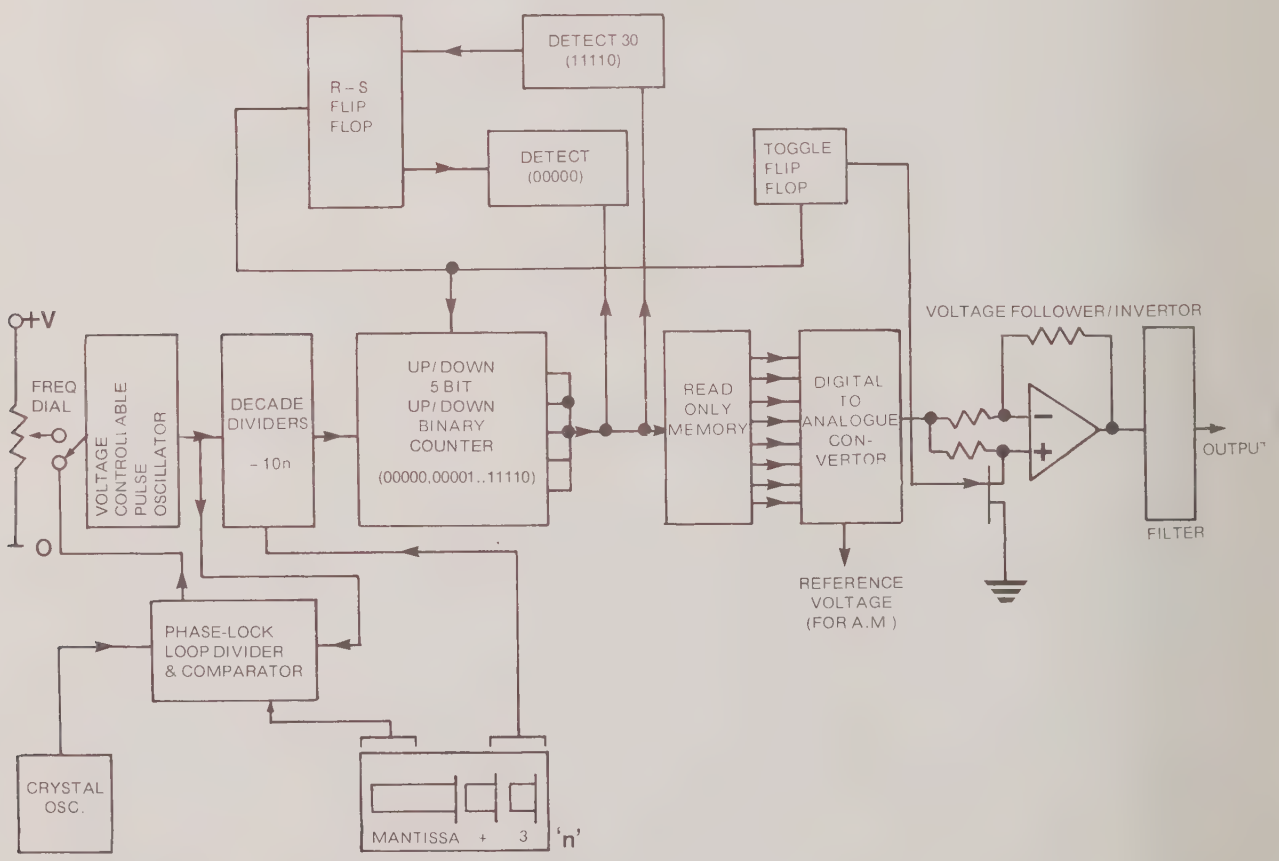
FREQUENCY RESPONSE GRAPH
(TRANSFORMER COUPLED OUTPUT)



CIRCUIT DESCRIPTION

Basic principle

The DSG2 generates sine waves by re-constructing the sinusoid from 120 discrete voltage steps equally spaced in time along the complete cycle. The voltage corresponding to each step can be stored as a number within the scale -255 to +255 in a digital read-only memory (ROM). The DSG2 stores only the numbers relating to the first quarter cycle. The memory is read in reverse order for the second quarter, and the process repeated, with a waveform inversion, for the third and fourth quarters. The rate at which the memory is read determines the frequency of the output sine waves which will be 120 times slower than the 'clock' frequency. The clock is generated from a voltage controlled pulse frequency generator, which is phase-locked to a crystal by way of a presettable frequency divider in Digital and Bus modes, so that accurate frequencies may be set. A block diagram of the system is shown below.



Oscillator & frequency synthesizer board [components prefix 100]

Monostable IC3 is retriggered from its own output falling edge to form a pulse oscillator with frequency determined by the charging current from TR2. Voltage control of the frequency is effected by inputs to TR1, which in Dial and Ext modes are taken via IC4 to this voltage control. Feedback to IC4 linearises the control of frequency. In Digital or Bus mode the frequency output from IC3 is taken to the four decade presettable divider formed by IC11-14. IC14 is a 4 bit binary counter which counts up to 15, allowing frequencies up to 15999 to be set. IC9 and 10 are used to speed operation of the counter by forming a 'look ahead' circuit as the count approaches zero. The frequency data from either thumbwheels or GPIB bus is loaded into the divider IC's from data selectors IC16 to 19. In Digital mode the data is clocked through these selectors continuously by the 1.2kHz reference frequency at TR4 whereas, in Bus Operation, the appropriate data is clocked through when the decoding circuit on the Bus board generates strobe signals for this purpose. The reference signal of 1.2kHz is generated from the division by IC5, a 12 bit counter, of the 4.9152MHz frequency generated by crystal oscillator IC5 & XTL1. The output from the presettable divider is compared with this reference signal in phase comparator IC2, the output of which is filtered by IC1 and used as a control signal for the voltage controlled oscillator. The control is such that a phase-locked loop is formed, locking the output of the divider to the reference signal. The reference signal is also taken to an otherwise unused input of IC3 (pin 3) to ensure that this oscillator always starts. The signal frequency output from this board is taken to the logic board.

Logic board [components prefix 200]

The signal frequency from the oscillator board clocks a cascade of 8 decade dividers in IC17-18 & 22-23. The exponent section of the frequency setting from either the thumbwheels or the bus determines which of these divided outputs is selected. The data-selector, IC15, on the oscillator board provides this information in b.c.d. format which is decoded and selected by IC16 (positive exponents) or IC21 (negative exponents). The exponent information is also decoded by IC12 and passed to driver IC11 to select filter relays on the analogue board. The output frequency selected from these dividers is 120 times the ultimate output frequency, and is used to clock an up-down counter which addresses the ROM storing the step voltages, as well as providing the back panel 120f output. IC20, 27 and ½ IC28 form the 5 bit up-down counter, with a look-ahead circuit, IC15, 19, 26 to speed the up-to-down transition at the count of 31, with two gates in IC19 sensing the count of zero for the down-to-up transition. At each transition of zero the bistable in IC27 is toggled after a short delay from IC25. This signal is used for the TTL output and for driving the waveform inverter on the analogue board. The value of the count is taken via gates in IC14 to the address lines of the ROM, IC8. IC14 provides for selecting only the highest address when a square wave output is required. This selection in manual operation is gated by ½ IC29, and in Bus operation by ½ IC24 to data latch IC26, which controls the address gates in IC14. The digital output from the ROM drives digital to analogue converter (DAC) chip, IC9, which provides a current output to the analogue board. The overall amplitude of this current output from the DAC is proportional to the reference current derived from IC10. This current is constant in manual operation, but in Bus mode it is varied in proportion to the voltage tapping selected by multiplexer ICs 4-5 from the potential divider chain, R7-R17. The selection made by these multiplexers is in response to data for the 0.1dB attenuation steps commanded from the Bus. This data is latched in IC3 by a strobe from the Bus board. The data for the 1 and 10dB steps is latched on this board by IC2 and IC1 respectively. Selection of 1dB steps is active in Bus mode only, but the selection of 10dB steps may also be made from the front panel switches in manual mode. The switch information is encoded in b.c.d. format by IC30 prior to data selection and latching by IC1. The 1 and 10dB attenuator, housed in a separate box, is a passive 50 ohm network switched by relays driven from IC6 and IC7.

Analogue board [components prefix 300]

The current signal from the DAC on the logic board is taken to the input of IC7 which serves as a current to voltage converter amplifier. The output from this stage appears as a full wave rectified sine wave. This is followed by an operational amplifier, IC6, which is alternately switched between inverting and non-inverting amplification by TR5, controlled by the waveform inversion signal from the logic board. The resulting sinusoidal output is filtered using a Sallen-Key circuit around IC1. Appropriate filter capacitors are selected by relays RL1-5 for each of the positive exponent frequency ranges with all capacitors switched in for the negative exponent ranges. The filtering removes the quantisation noise (the steps) resulting in a smooth sine wave. For square wave operation all the relays remain open and C16 is used to trim for best rise time. The signal from the filter is passed via the front panel fine amplitude control to the output amplifier.

This is a conventional Class B circuit using TR2 and TR1 for voltage amplification and four transistors mounted on the back panel, TR1-4 (not prefixed 300), to form a high slew rate driver and complementary output. The output signal is passed to the attenuator circuit. The output signal is also taken to an active meter circuit comprising TR6-8 and associated components. These transistors are connected to form a current output from a very high impedance which is thus forced to pass through diode-capacitor bridge D18, D20, C46, C47. This gives a d.c. current for the meter which is very linearly related to the rectified mean level of the signal. To compensate for the difference in dial calibration between sine and square wave operation,an analogue gate in IC5 is used to reduce the gain of the circuit when square wave output is selected.

The power supply circuit is also rectified and stabilised on the analogue board. A centre-tapped bridge rectifier arrangement using diodes D5, 6, 11, 12 and reservoir capacitors C33 and 34 generate +35V and -35V unstabilised lines. TR3, 4 and zener diodes Z4 and 5 are used to provide stabilised +25V and -25V lines. Supplied from the 25V lines, I.C. regulators IC2 and 3 provide highly stabilised +15V and -15V lines. A separate secondary from the mains transformer, together with bridge D13, 14, 16, 17, reservoir capacitor C35 and IC regulator IC4, provides a stabilised 5V line for the logic circuits.

Attenuator [components prefixed 400]

The attenuator for the 10dB steps (front panel and bus selectable) and 1dB steps (bus control only), is housed in a separate screened box. It is a sequence of resistive PI section pads in a 1-2-4-8 binary sequence, the appropriate pads being selected by relays driven from signals decoded on the logic board. The output is either passed direct to the 50 ohm output socket, or to an isolation transformer mounted on the analogue board, depending on the selection of the front panel switch. A split secondary on this transformer is connected to the balanced output sockets.

GPIB bus interface [components prefixed 500]

The incoming lines from the IEEE488 bus are resistively terminated in accordance with the standard, and buffered by IC2 and IC4 before connection to IC3, which is a special integrated circuit dedicated to handling all the bus handshake routines and protocols. The data lines 1 to 4, after buffering, are also passed to IC11 and to the data latches on the oscillator and logic boards. IC1 and XT1 are used to form a clock oscillator for IC3 and a separate gate in IC1 also provides a power-on reset. The bus address of the unit, selected on the slider switches SW1, is parallel loaded into shift register IC5 which outputs this serially into IC3 when strobed by IC3.

The syntax followed by the Farnell range of GPIB equipment for bus commands takes the form of a letter followed by numeric data where necessary. The combination of IC7, 8 and 11 detects that a letter has been sent and decodes which function is being commanded. For setting frequency upon receipt of letter 'F', pin 8 of IC7 goes low, which resets counter IC12 and sets the number 2 bistable in IC15. This bistable, together with gates in IC8, allow subsequent 'data-valid' pulses from IC3 to clock the counter, IC12, and also opens a gate in IC9 to allow the data-valid pulses through to the frequency strobe drivers IC17 and ¾ IC14.

As each new character is sent on the bus, counter IC12 is incremented and the current count value is decoded by IC16 to activate each strobe driver in turn. When the seventh character is received, the strobe for the seventh digit is used to reset the bistable in IC15. An exactly similar sequence of events is followed when attenuation is to be programmed, except it is the number 1 bistable in IC15 which is set when the letter 'A' is received. Monostable IC10 is used to stretch pulses from the data-valid line to illuminate the panel 'listening' LED. Two of the gates in IC13 are used to provide power-on reset pulses to IC12 and IC15.

MAINTENANCE

Guarantee

The equipment supplied by Farnell Instruments Ltd., is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of despatch. In the case of material or components employed in the equipment but not manufactured by us, we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to despatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

Maintenance

In the event of difficulty, or apparent circuit malfunction, it is advisable to telephone (or telex) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

For repairs and recalibration it is recommended that the complete instrument be returned to;-

The Service Department,
Farnell Instruments Ltd.,
Sandbeck Way,
Wetherby,
West Yorkshire.
LS22 4DH.
Tel. 0937 61961 Telex 557294

or

The Service Department,
Farnell Instruments Ltd.,
Davenport House,
Bowers Way,
Harpenden, Herts.
AL5 4HX.
Tel. 05827 69071 Telex 826307

Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss.

RECALIBRATION

For those possessing a comprehensive service facility the following is given as a guide to the re-calibration of a DSG2. This procedure should be followed as a matter of course after any repair work has been conducted.

Equipment required

50MHz bandwidth oscilloscope
Frequency counter
Digital multimeter (DM131, DM141)
Distortion analyser
Megger

Access to the unit may be gained by slackening the four retaining screws (marked by a white spot) on the back panel by about 5mm. This allows the panel to move backwards, thus allowing the top and bottom covers to be removed from their retaining grooves, so giving access to the circuit boards.

Extract the plug from socket 4 on the analogue (power supply) board. Ensure that the mains selector is set to 240V and insert a 500mA fuse. For convenience, unplug and remove the bus board.

1. POWER SUPPLY

1.1. Connect to mains supply, preferably from a variac, and switch on. Slowly increase the mains supply voltage to 240V. Check the neon lights. Check power supplies as follows: +40V, -40V and +10V raw lines across reservoir capacitors C33, C34 and C35. Fit fuses on analogue board.

1.2. Check the stabilised lines: +25V (±1V) across C15, -25V (±1V) across C22, +15V (±0.5V) across C23, -15V (±0.5V) across C32 and +5V (±0.2V) across C40.

2. OSCILLATOR AND SYNTHESIZER

2.1. Plug in plug 4 and move on to the oscillator board. Check +5V at pin 14 of IC6 and +15V at pin 16 of IC5.

2.2. Check that the crystal oscillator is working - output at test point TP1 of 4.9152MHz and of 1.2kHz at pin 1 of IC2.

2.3. Position the front panel switch to Dial, adjust Fine Frequency and check VCO is operational by scope probe to 'R9' end of R9 or TP2.

2.4 Check divide-by-N circuit as follows:-

Front panel thumbwheels to 0.003
Scope probe to pin 8,IC10
Check pulses appear on scope and are adjustable by Fine Frequency control.
Choose a middle position setting of the dial and scope timebase to 0.1µs/div. Adjust Fine Frequency so that pulses occur at a rate of 1 every 3 divisions. Alter least significant thumbwheel through 4, 5, 6, etc. and check that the spacing of pulses increases in the same manner. Work on through the other wheels in a similar manner from right to left, reducing the scope timebase speed by 10 as each new thumbwheel is tested.

2.5. Move to logic board. Check +5V on pin 14 of IC20. Set thumbwheel exponent to +4. Scope probe to pin 1 of IC27. Check that pulses are present (roughly 10MHz). Thumbwheel to +3, +2, etc. through to -4, checking that the frequency of the pulses on the scope is divided by 10 for each step. Return to +4.

3. WAVEFORM SYNTHESIS

3.1. Check pin 1 of IC28 for square wave of period 6µs for full cycle.

3.2. Check pin 8 of IC27 for square wave of period 12µs. Set frequency controls to digital 1.000+3.

3.3. Check that adjustment of P1 varies the voltage on pin 6 of IC10. Leave set fully anticlockwise - voltage maximum.

3.4. Move to analogue board. Turn Fine Amplitude control fully anticlockwise. Select Direct coupled output and connect scope probe to marked end of R27. Adjust P1 to give zero d.c. offset.

3.5. Set Fine Amplitude fully clockwise. Select square wave. Scope probe on junction of R39 and R40 (unmarked end).
Initially adjust P11 to give approximately 1.5V.

3.6. Scope probe to "R25" end of R25, adjust P5 to give symmetrical square wave about zero.

3.7. Scope probe to R27. Adjust P10 fully anticlockwise, adjust P11 to give 22V pk-pk.

4. D.C. BIAS

4.1. At an intermediate amplitude setting - about 10V p-p, adjust P2 to give symmetrical waveform about zero. The trimmer interacts with the setting of P1 so the d.c. level at zero output amplitude should be rechecked and adjusted if necessary with P1, repeating these two adjustments until both are correct.

5. DISTORTION CHECK

5.1. Switch to sine wave. Monitor output with scope and distortion analyser. Using P5 and P8 adjust for minimum distortion at 1kHz set using thumbwheels.

6. EXT. AND DIAL FREQ. ADJUSTMENTS - OSCILLATOR BOARD

6.1. Frequency counter on to "R9" end of R9. Switch to Ext.

6.2. Connect voltage supply to ext i/p and set to 0V, adjust P3 until a frequency of 500kHz is read on the counter.

6.3. Increase voltage supply to +10V. Check counter reading and trim P4 for reading of 12.0MHz.

6.4. Switch to dial. Trim P2 fully clockwise. Turn Fine Frequency control slowly anticlockwise to the point where the frequency stops reducing. Fix the knob on the shaft with the white line set to '0'. With the pot in this position adjust P2 to give a frequency of 500kHz.

6.5. Top of Dial. Turn Fine Frequency control to '10' and adjust P1 for frequency of 12MHz. As adjustments of P1 and P2 inter-react, repeat steps 6.4 and 6.5 until both conditions are satisfied.

6.6. Crystal Oscillator. Connect counter probe to test point TP1 and adjust C22 to give frequency of 4.9152MHz exactly. If necessary, change value of C24.

7. FILTER SETTING

7.1. Change frequency setting 10999 and exponent to +4. Monitoring output on scope, adjust C9 and C12 so that the amplitude remains constant within ±5% over range of adjustment of Fine Frequency control, using Dial mode, first by adjusting both so that amplitude reduction at 109kHz is a minimum, then increase each by equal increments until a 5% loss of amplitude is achieved. Check distortion is within spec- use digital setting of 10.000+4.

8. METER CHECK

8.1. When the instrument is switched off ensure that the meter needle is adjusted to zero with mechanical zero adjust. Set frequency to 1kHz sine wave and adjust the output level to exactly 3.162V into 50Ω using DM141 multimeter. Using P3, adjust meter reading to 10V mark. Switch to square wave. Check voltage is 5.00V on DM141 and adjust P4 for meter reading of 10V.

9. ATTENUATOR CHECK

9.1. Using the voltmeter section of the distortion analyser, check down the attenuator ranges for meeting the accuracy specification.

10. TRANSFORMER CHECK

10.1. Set frequency to 5kHz sine wave, output to 3V sine wave, select Transformer coupling and monitor output voltage across full balanced output. Check this voltage on open circuit and into an accurate 600Ω load. Adjust P6 so that the voltage exactly halves on load.

10.2. Also check that there is half the output voltage to the centre tap from each side within ±3%. Check the centre tap is isolated from chassis (Megger).

11. BUS BOARD OPERATION

11.1. Remove the supply to the DSG2 and refit the bus board, make connections to the bus socket (back panel) and to the oscillator and logic boards. Reconnect the mains and switch on. Select 'BUS' operation.

11.2. Check action of power-on reset to pin 12 of IC3.

11.3. Check crystal oscillation functioning - a square wave at pin 4, IC1 of 1MHz.

11.4. Check clock frequency input to pin 10, IC5 spans CMOS logic levels.

11.5. Perform functional check using test programme on controller (PET or HP85).

12. OUTPUTS

12.1. TTL Output.
Restore dial or digital operation. Connect TTL output to a simulated 5TTL load. (600 ohm resistor from 5V). Check that square wave is present within TTL limits (<0.8V to >2.4V)at same frequency as main output - check at 100kHz and various other frequencies.

12.2. 120f output (rear panel)

Connect simulated 5TTL load to 120f output and check that a pulse at a repetition frequency of 120 times main output is present. Check levels are within TTL limits.

12.3. Square wave

Select square wave operation at 100kHz. Monitor main output loaded by 50Ω on oscilloscope. Adjust C16 for best square wave and check that rise and fall times are within specification.

COMPONENTS LISTS

DRAWING No | ASSEMBLY No 5NDSG20L | USED ON DSG 2

CCT. DIA. REF.	VALUE	RATING	TOL:%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
PCB								
R101	10	0.4W	2	Mullard	MR25	MF	RM210R025	
2	560						RM3560R25	
3	8K2						RM48K2025	
4	27K						RM527K025	
5	12K						RM512K025	
6	12K						RM512K025	
7	1K8						RM41K8025	
8	33K						RM533K025	
9	1K0						RM41K0025	
10	270						RM3270R25	
11	910						RM3910R25	
12	10						RM210R025	
13	1K2						RM41K2025	
14	1K5						RM41K5025	
15	10						RM210R025	
16	56K						RM556K025	
17	3K3						RM43K3025	
18	10						RM210R025	
19	1K5						RM41K5025	
20	10K						RM510K025	
21	3K3						RM43K3025	
22	10M						RC610M025	
23	8K2						RM48K2025	
24	4K7						RM44K7025	
25	"						"	
26	"						"	
27	"						"	
28	"						"	
29	"						"	
30	"						"	
31	"						"	
32	"						"	
33	8K2						RM48K2025	
34	2K2						RM42K2025	
35	2K2						"	
36	4K7						RM44K7025	
37	"						"	
38	"						"	
39	"						"	
40	"						"	
41	"						"	
42	"						"	
43	"						"	
44	"						"	
45	"						"	
46	"						"	
47	"						"	
48	"						"	

CCT. DIA. REF.	VALUE	RATING	TOL:%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
R149	4K7						RM44K7025	
50	"						"	
51	560						RM3560R25	
52	"						"	
53	"						"	
54	"						"	
55	Wire link							
C101	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
2	47p	100V	10	Mullard	642	CE	CC247P0N642	
3	0u1	100V	10	Wima	MK53	PF	CF0U100NMK53	
4	1u0	100V	10	Mullard	344	PM	CF11U00N344	
5	0u22	100V	10	Siemens	32511	PM	CF0U220N325	
6	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
7	10u	25V	20	Mullard	015	E	CE210U0GM	
8	47u	10V	20	Mullard	015	E	CE247U0DM	
9	330	100V	10	Mullard	642	CE	CC3330PN642	
10	470u	6.3V	20	Mullard	016	E	CE3470U0CM	
11	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
12	220	10V	20	Mullard	016	E	CE3220U0DM	
13	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
14	82p	100V	10	Mullard	642	CE	CC282P0N642	
15	0u1	100V	10	Wima	MK53	PF	CF0U100NMK53	
16	"	"	"	"	"	"	"	
17	10u	25V	20	Mullard	015	E	CE210U0GM	
18	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
19	10n	"	"	"	"	"	"	
20	10n	"	"	"	"	"	"	
21	10n	"	"	"	"	"	"	
22	10-40			Steatite	TOS/Trito		CV21040P10S	
23	47p	100V	10	Mullard	642	CE	CC247P0N642	
24	56p	100V	10	Mullard	642	CE	CC256P0N642	
25	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
26	"	"	"	"	"	"	"	
27	"	"	"	"	"	"	"	
28	"	"	"	"	"	"	"	
29	"	"	"	"	"	"	"	
30	"	"	"	"	"	"	"	
31	"	"	"	"	"	"	"	
32	"	"	"	"	"	"	"	
33	"	"	"	"	"	"	"	

DRAWN

ISS	DATE	Q.C No	CHECKED	ISS	DATE	Q.C No	CHECKED

COMPONENT TYPE ABBREVIATIONS

CAPACITORS
- CE CERAMIC
- E ELECTROLYTIC
- PC POLYCARBONATE
- PF POLYESTER FILM
- PM POLYESTER METALIZED
- PP POLYPROPELENE
- PS POLYSTYRENE
- SM SILVER MICA
- T TANTALUM

RESISTORS
- C CARBON
- CF CARBON FILM
- CM CERMET
- MF METAL FILM
- MG METAL GLAZE
- MO METAL OXIDE
- P PLASTIC
- WW WIRE WOUND

POTENTIOMETERS
- C CARBON
- CM CERMET
- P PLASTIC
- WW WIRE WOUND

INTEGRATED CIRCUITS
- CE CERAMIC
- MC METAL CAN
- P PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W.YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Oscillator Logic

DRAWING No: 1SZX0158

SHEET 3 OF 4 SHEETS

DRAWING No | ASSEMBLY No 5NDSG20L | USED ON DSG 2

CCT DIA REF	VALUE	RATING	TOL:%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
C134	100p	100V	10	Mullard	642	CE	CC3100PN642	
35	10u	100V	10	Mullard	FKS2min	PF	CFS10K0N2M1N	
36	10u	25V	20	Mullard	015	E	CE210U0GM	
37	22u	25V	20	Mullard	015	E	CE222V0GM	
38								
P101	2K			Spectrol	63p	CM	PM42K0063P	
2	1K			Spectrol	63p		PM41K0063P	
3	10K			Spectrol	63p	CM	PM510K063P	
4	5K			Spectrol	63p	CM	PM45K0663P	
P105	5K			AB	16	C	PC45K0016	Front Panel
TR101				Ferranti	BC182PL		VT182PL	
2				"	BC212PL		VT212PL	
3				Ferranti	BC182PL		VT182PL	
4				"	"		"	
C101				RCA	CA3130E	P	VA3130E	
2				Motorol	MC4044P	P	VD4044P	
3				Texas	SN74121N	P	VD74121N	
4				RCA	CA741CG	P	VA741CG	
5				"	CD4060BCN	P	VD4060BCN	
6					SN74LS00N	P	VD74LS00N	
7					SN74LS00N	P	"	
8					SN74LS02N		VD74LS02N	
9					SN74LS30N		VD74LS30N	
10					SN74LS74N		VD74LS74N	
11					SN74LS190N		VD74LS190N	
12					"		"	
13					"		"	
14					SN74LS191N		VD74LS19N	
15					SN74LS298N		VD74LS298N	
16					"		"	
17					"		"	
18					"		"	
19					"		"	
XT101	4.9152MHz			Crystal			VX49152	

CCT DIA REF	VALUE	RATING	TOL:%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
D101					1N4148		DG4148	
102					1N4148		DG4148	
SW101-4	Function Switch				3ST0040		SB040	Front Panel
Listening LED				General Inst.	MV5753		LD134	Front Panel
VCO Input					UG1094/BU		TR1094	Front Panel
Thumbwheel Switch				Cosmacord	3ST0045		SL045	Front Panel

DRAWN

ISS	DATE	Q.C No	CHECKED	ISS	DATE	Q.C No	CHECKED

COMPONENT TYPE ABBREVIATIONS

CAPACITORS
- CE CERAMIC
- E ELECTROLYTIC
- PC POLYCARBONATE
- PF POLYESTER FILM
- PM POLYESTER METALIZED
- PP POLYPROPELENE
- PS POLYSTYRENE
- SM SILVER MICA
- T TANTALUM

RESISTORS
- C CARBON
- CF CARBON FILM
- CM CERMET
- MF METAL FILM
- MG METAL GLAZE
- MO METAL OXIDE
- P PLASTIC
- WW WIRE WOUND

POTENTIOMETERS
- C CARBON
- CM CERMET
- P PLASTIC
- WW WIRE WOUND

INTEGRATED CIRCUITS
- CE CERAMIC
- MC METAL CAN
- P PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Oscillator Logic

DRAWING No: 1SZX0158

SHEET 4 OF 4 SHEETS

DRAWING No 1SZX0158 | ASSEMBLY No 5NDSG2SL | USED ON DSG2

CCT DIA REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
PCB							EC...3a	
A...1	1K2	...	2	M...lard	ME2	MF	RM4...K2...5	
	...K	"	"	"	"	"	RM...K...5	
	1K8	"	"	"	"	"	RM...K...5	
	1K5	"	"	"	"	"	RM...K...5	
	12K	"	"	"	"	"	RM...K...5	
	1K8	"	"	"	"	"	RM...K...5	
	...	"	"	"	"	"	RM...K...5	
	2K0	"	"	"	"	"	RM...K...5	
9	12	"	"	"	"	"	RM3120R25	
10	...	"	"	"	"	"	RM...2...5	
11	120	"	"	"	"	"	RM3120R25	
12	110	"	"	"	"	"	RM3110R25	
13	120	"	"	"	"	"	RM3120R25	
14	120	"	"	"	"	"	RM3120R25	
15	120	"	"	"	"	"	RM3120R25	
16	110	"	"	"	"	"	RM3110R25	
17	10K	"	"	"	"	"	RM510K025	
18	2K0	"	"	"	"	"	RM42K0025	
19	1K5	"	"	"	"	"	RM41K5025	
20	10K	"	"	"	"	"	RM510K025	
21	4K7	"	"	"	"	"	RM44K7025	
22	4K3	"	"	"	"	"	RM44K3025	
	4K3	"	"	"	"	"	RM44K3025	
24	1u	"	"	"	"	"	RM...u...5	
25	10	"	"	"	"	"	RM210R025	
26	10	"	"	"	"	"	RM210R025	
27	10K	"	"	"	"	"	RM510K025	
28	4K7	"	"	"	"	"	RM44K7025	
29	4K7	"	"	"	"	"	RM44K7025	
30	4K7	"	"	"	"	"	RM44K7025	
31	4K7	"	"	"	"	"	RM44K7025	
32	4K7	"	"	"	"	"	RM44K7025	
	4K7	"	"	"	"	"	RM44K7025	
	4K7	"	"	"	"	"	RM44K7025	
	4K7	"	"	"	"	"	RM44K7025	
...	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN		
...	"	"	"	"	"	CF510K0N2MIN		
...	"	"	"	"	"	CF510K0N2MIN		
...	"	"	"	"	"	CF510K0N2MIN		
10u	25V	20	Mullard	015	E	CE210U0GM		
6 10u	"	"	"	015	E	CE210U0GM		
7 10u	"	"	"	015	E	CE210U0GM		
8 10n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN		
9 10n	"	"	"	"	"	CF510K0N2MIN		
10n	"	"	"	"	"	CF510K0N2MIN		

CCT DIA REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
C 11	10n	16	10	Wima	FK52MIN	PF	CF510K0N2MIN	
1...	10n	"	"	"	"	"	"	
13	10n	"	"	"	"	"	"	
14	10n	"	"	"	"	"	"	
15	10n	"	"	"	"	"	"	
16	10n	"	"	"	"	"	"	
17	10n	"	"	"	"	"	"	
18	10n	"	"	"	"	"	"	
19	10n	"	"	"	"	"	"	
20	10n	"	"	"	"	"	"	
...	10n	"	"	"	"	"	"	
...	16n	"	"	"	"	"	"	
...	10n	16	5	Mullard	642	CE	CC268P0N642	
1	68nF	10n	5	Mullard	642	CE	CC268P0N642	
...	10n	160	10	Wima	MKS3		CF0U100NMKS3	
...	10n	1...	16	Wima	FK52MIN	PF	CF510K0N2MIN	
...	10n							
...	1n0							
2201	5V1	400mW	5	ITT	ZPD5V1		D2PD5V1	
2	5V1	"	"	"	"		"	
D201	2K0			Spectrol	63P	CM	PM42K0063P	
1					$N74L$298N		VD74L$298N	
2				Texas	$N74L$174N		VD74L$174N	
3					$N74L$174N		VD74L$174N	
4				RCA	CD4051BCN		VD4051B	
5				"	CD4051BCN		VD4051B	
6					$N7406N		VD7406N	
7					$N7406N		VD7406N	
8				Farnell	ROM		VA765146	
9					NE5008N		VA5008N	
10				RCA	CA741CG		VA741CG	
11				Texas	$N7407N		VD7407N	
12					$N74L$42N		VD74L$42N	
13					$N74L$00N		VD74L$00N	
14					$N74L$32N		VD74L$32N	
15					$N74L$30N		VD74L$30N	
16					$N74L251N		VD74L$...1N	
17					$N74L$490N		VD74L$490N	
18					$N74L$490N		VD74L$490N	
19				Texas	$N74L$02N		VD74L$02N	
20					$N74LS193N		VD74L$193N	
21								
22					$N74L$490N		VD74L$490N	
23					$N74L$490N		VD74L$490N	
24				Texas	$N74L$08N		VD74L$08N	
25				Texas	$N74121N		VD74121N	
26					$N74LS74N		VD74LS74N	
27					$N74L$73N		VD74L$73N	
28					$N74L$10N		VD74L$10N	

ISS	DATE	Q.C. No	CHECKED	ISS	DATE	Q.C. No	CHECKED

DRAWN

COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CER... ELECTROLYT... POLYCARBONATE ... POLYESTER F...M ... POLYESTER METALLIZED ... POLYPROPELENE ... POLYSTYRENE ... SILVER MICA ... TANTALUM

RESISTORS: ARBON ... ARBON FILM ... CERMET ... METAL FILM ... METAL GLAZE ... METAL OXIDE ... PLASTIC ... WIREWOUND

POTENTIOMETERS: ARBON ... CERMET ... PLASTIC ... WIRE WOUND

INTEGRATED CIRCUITS: CERAMIC ... METAL CAN ... PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Synthesizer logic

DRAWING No: 1SZX0158

SHEET 1 OF 2 SHEETS

DRAWING No 1SZX0153 | ASSEMBLY No ... | USED ON DSG2

CCT DIA REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
					$N7412N		VD7412N	
					$N74148N		VD74148N	
				Farnell	...		...	
				Farnell	...		SB0042	
					...		TR1094	Front panel

ISS	DATE	Q.C. No	CHECKED	ISS	DATE	Q.C. No	CHECKED

DRAWN

COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CERAMIC ... ELECTROLYTIC ... POLYCARBONATE ... POLYESTER F...M ... POLYESTER METALLIZED ... POLYPROPELENE ... POLYSTYRENE ... SILVER MICA ... TANTALUM

RESISTORS: ARBON ... ARBON FILM ... CERMET ... METAL FILM ... METAL GLAZE ... METAL OXIDE ... PLASTIC ... WIREWOUND

POTENTIOMETERS: ARBON ... CERMET ... PLASTIC ... WIRE WOUND

INTEGRATED CIRCUITS: CERAMIC ... METAL CAN ... PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Synthesizer logic

DRAWING No: 1SZX0153

SHEET 2 OF 2 SHEETS

DRAWING No 1SZX0160 | ASSEMBLY No 5NDSG2A | USED ON DSG2

CCT. DIA REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL'%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
							IBC030	
R301	12	0.4W	2	Mullard	MR25	MF	RM212RC25	
2	2K7	2.5	"	"	MR30	MF	RM42K7G30	
3	12	0.4	"	"	MR25	"	RM212R025	
4	560	"	"	"	"	"	RM3560R25	
5	4K7	"	"	"	"	"	RM44K7025	
6	8.2	1.0	25	Electrocil	TR6	M	RX3820RT6	
7	390	0.5	2.0	Mullard	MR30	MF	RM3390R30	
8	3K9	0.4	"	"	MR25	"	RM43K9025	
9	10	"	"	"	"	"	RM210R025	
10	12	"	"	"	"	"	RM212R025	
11	12	"	"	"	"	"	RM212R025	
12	47	"	"	"	"	"	RM247R025	
13	1	"	"	"	"	"	RM212R025	
14	1	"	"	"	"	"	RM212R025	
15	220	"	"	"	"	"	RM3220R25	
16	2K2	"	"	"	"	"	RM42K2025	
17	100	"	"	"	"	"	RM3100R25	
18	330	"	"	"	"	"	RM3330R25	
19	5K6	"	"	"	"	"	RM45K6025	
20	1	"	"	"	"	"	RM41K2525	
21	2K2	"	"	"	"	"	RM52K2G25	
22	150	2.5W	5	Welwyn	PS86	MO	RX3150R86	
23	150	2.5W	5	Welwyn	PS86	MO	RX3150R86	
24	82	0.4	2	Mullard	MR25	MF	RM282R025	
25	1	"	"	"	"	"	RM515K025	
26	39	2.5W	5	Welwyn	W21	WW	RW3390R21	
27	47	2.5W	5	Electrocil	TR6	MO	RX247R026	
28	10	0.4	2	Mullard	MR25	MF	RM210R025	
29	390	2.5W	5	Welwyn	W21	WW	RW3390R21	
30	3K3	0.4	2	Mullard	MR25	MF	RM43K3025	
31	1K2	"	"	"	"	"	RM46K8025	
32	12K	"	"	"	"	"	RM412K025	
33	12K	"	"	"	"	"	RM43K3025	
34	3K3	"	"	"	"	"	RM43K3025	
35	5K	"	"	"	"	"	RM515K025	
36	2K2	"	"	"	"	"	RM42K2025	
37	10	"	"	"	"	"	RM210R025	
38	1	"	"	"	"	"	RM41K0025	
39	1	"	"	"	"	"	RM41K5025	
40	1K5	"	"	"	"	"	RM41K5025	
41	15K	"	"	"	"	"	RM515K025	
42	1K2	"	"	"	"	"	RM41K2025	
43	18K	"	"	"	"	"	RM518K025	
44	2K2	"	"	"	"	"	RM212R025	
45	10	"	"	"	"	"	RM210R025	
46	1	"	"	"	"	"	RM41K0025	
47	1	"	"	"	"	"	RM41K5025	
48	1K5	"	"	"	"	"	RM41K5025	
49	1K	"	"	"	"	"	RM43K9025	
50	10K	"	"	"	"	"	RM210R025	

CCT. DIA. REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL'%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
R349	1K5	0.4W	2	Mullard	MR25	MF	RM41K5025	
50	10K	"	"	"	"	"	RM510K025	
51	1K0	"	"	"	"	"	RM41K0025	
52	56K	"	"	"	"	"	RM556K025	
53	10	"	"	"	"	"	RM210R025	
54	10	"	"	"	"	"	RM210R025	
55	Not fitted							
56	Not fitted							
57	Not fitted							
58	47Ω	0.4W	2	Mullard	MR25	MF	RM3470R25	
59	1K0	"	"	"	"	"	RM41K0025	
60	820	"	"	"	"	"	RM3820R25	
61	470	"	"	"	"	"	RM3470R25	
62	82						RM282R025	
C301	3P3	100V	10%	Mullard	642	CE	CC13P30N642	
2	10n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
3	5P6	100V	10	Erie	861/N470	CE	CC15P60B61	
4	560P	100V	10	Erie	831/AC	CE	CC3560P831	
5	220µ	10V	20	Mullard	016	E	CE3220UDM	
6	18P	100V	10	Mullard	642	CE	CC218P0N642	
7	10µ	25V	20	Mullard	015	E	CE210U0GM	
8	10n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
9	10P-40P			Steatite	10S	Trimmer	CV21040P105	
10	4P7	100V	10	Mullard	642	CE	CC14P70N642	
11	0.1	100V	10	Wima	MK53	PF	CF0U100NMK53	
12	10P-40P			Steatite	10S	Trim	CV21040P105	
13	82P	100V	10	Mullard	642	CE	CC282P0N642	
14	82P	"	"	"	"	"	CC282P0N642	
15	10µ	63V	20	Mullard	016	E	CE210U0LM6	
16	1P4-5P5	150V		Mullard	808-11558	Trimmer	CV11455P	
17	3P9	100V	10	Mullard	642		CC13P90N642	
18	22P	100V	10	Mullard	642	CE	CC222P0N642	
19	1n0	63V	2.5	ITT	PP5	PF	CF41K00LPP5	
20	1n0	63V	2.5			PF	CF41K00LPP5	
21	0.22	100V	10	Siemens	32511	PF	CF0U220N325	
22	10µ	63V	20	Mullard	016	E	CE210U0LM6	
23	10µ	25V	20	Mullard	015	E	CE210U0GM	
24	10µ	25V	20	Mullard	015	E	CE210U0GM	
25	10n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
26	0.1	100V	10	Wima	MK53	PF	CF0U100NMK53	
27	10n	63V	2.5	ITT	PP563	PS	CF510K0LPP5	
28	10n	"	"			PS	CF510K0LPP5	
29	0.1	160V	5	Ashcroft	B2A	PF	CF0U100PB2A	

ISS	DATE	O.C No	CHECKED	ISS	DATE	O.C No	CHECKED

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COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CE CERAMIC; E ELECTROLYTIC; PC POLYCARBONATE; PE POLYESTER FILM; PM POLYESTER METALIZED; PP POLYPROPELENE; PS POLYSTYRENE; SM SILVER MICA; T TANTALUM

RESISTORS: C CARBON; CF CARBON FILM; CM CERMET; MF METAL FILM; MG METAL GLAZE; MO METAL OXIDE; P PLASTIC; WW WIRE WOUND

POTENTIOMETERS: C CARBON; CM CERMET; P PLASTIC; WW WIRE WOUND

INTEGRATED CIRCUITS: CE CERAMIC; MC METAL CAN; P PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Analogue and Attenuator DSG2

DRAWING No 1SZX0160

SHEET 1 OF 3 SHEETS

GAF 4803/81

DRAWING No 1SZX0160 | ASSEMBLY No 5NDSG2A | USED ON DSG2

CCT. DIA REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL'%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
C330	0µ1	160V	5	Ashcroft	B2A	PF	CF0U100PB2A	
31	0µ22	100V	10	Siemens	B2511	PM	CF00220N325	
32	10µ	25V	20	Mullard	015	E	CE210U0GM	
33	1,000	50V	20	National	TSW	E	CE41K00KTM	
34	1,000	"	20	"	"	E	CE41K00KTM	
35	4µ7	16V	20	"	"	E	CE42K30FTM	
36	7P	100V	10	Mullard	642	CE	CC227P0N642	
37	0µ1	160V	1	Ashcroft	B2A	PL	CF11U00PB2A	
38	0µ1	160V	1	Ashcroft	B2A	PL	CF11U00PB2A	
39	0µ22	100V	10	Siemens	32511	PM	CF0U220N325	
40	100µ	10V	20	Mullard	016	E	CE3100UDM	
41	1n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
42	3n9	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
43	0µ1	63V	10	Wima	MK53	PF	CF0U100NMK53	
44	Not fitted							
45	220µ	16V	20	Mullard	016	E	CE3220UFM	
46	10µ	25V	20	Mullard	015	E	CE210U0GM	
47	1µ	"	"	"	"	"	CE210U0GM	
48	3µ3	35V	20	Mullard	016	E	CE3330UAM	
49	220µ	16V	20	Mullard	016	E	CE3220UFM	
50	1n	100V	10	Wima	FKS2MIN	PF	CF510K0N2MIN	
51	0µ1	"	"	"	"	"	CF510K0N2MIN	
52	0µ1	100V	10	Wima	MK53	PF	CF0U100NMK53	
53	0µ1	100V	10	Mullard	642	CE	CC239P0N642	
54	Not fitted							
55	Not fitted							
56	Not fitted							
57	Not fitted							
58	Not fitted							
59	Not fitted							
60	Not fitted							
61	Not fitted							
62	Not fitted							
Z301	Not fitted							
2	8V2	400mW	5	Mullard	BZY88		DZ88C8V2	
3	3V3			ITT	ZPD303		DZ2F33P	
4	24V	1.3W	5	Mullard	BZX61		DZ61C24	
5	24V	1.3W	5	Mullard	BZX61		DZ61C24	
6	5V1	400mW	5	ITT	ZF5.1P		DZF51P	

CCT. DIA. REF	COMPONENT DESCRIPTION: VALUE	RATING	TOL'%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
D301					1N4148		DG4148	
2					"		DG4148	
3					"		DG4148	
4					"		DG4148	
5					1N4003		DG4003	
6					1N4003		DG4003	
7					1N4148		DG4148	
8					1N4148		DG4148	
9					1N4003		DG4003	
10					1N4003		DG4003	
11					"		DG4003	
12					"		DG4003	
13					"		DG4003	
14					"		DG4003	
15					1N4148		DG4148	
16					1N4003		DG4003	
17					1N4003		DG4003	
18					1N4148		DG4148	
19					1N4148		DG4148	
20					1N4148		DG4148	
TR301					2N2218A		VT2218A	
2					2N2904		VT2904	
3					2N5294		VT5294	
4					BD240		VT240	
5				Ferranti	ZTX313		VTX313	
6				"	BC182PL		VT182PL	
7				"	BC182PL		VT182PL	
8				"	BC182PL		VT182PL	
9				"	BC212PL		VT212PL	
IC301				Analog Devices	AD518J		VA518J	
2				Fairchild	µA78M15CU		VA78MI5CU	
3				National	LM320T-15		VA320T15	
4				Texas	TY40147		VA40147	
5				National	CD4066CN		VD4066CN	
6				Analog Devices	AD518J		VA518J	
7					AD518J		VA518J	
8								
9								
RL301-305		24V		Omron	G2V2		SRG2V2	
SW301-302				Farnell	3ST0043/B		SB0043	
SW303-305		Not fitted						
TX302		Audio	TX	Farnell	3SR.263		ZR0263	

ISS	DATE	O.C No	CHECKED	ISS	DATE	O.C No	CHECKED

DRAWN

COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CE CERAMIC; E ELECTROLYTIC; PC POLYCARBONATE; PE POLYESTER FILM; PM POLYESTER METALIZED; PP POLYPROPELENE; PS POLYSTYRENE; SM SILVER MICA; T TANTALUM

RESISTORS: C CARBON; CF CARBON FILM; CM CERMET; MF METAL FILM; MG METAL GLAZE; MO METAL OXIDE; P PLASTIC; WW WIRE WOUND

POTENTIOMETERS: C CARBON; CM CERMET; P PLASTIC; WW WIRE WOUND

INTEGRATED CIRCUITS: CE CERAMIC; MC METAL CAN; P PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Analogue and Attenuator DSG2

DRAWING No 1SZX0160

SHEET 2 OF 3 SHEETS

DRAWING No 1SZX0160 | ASSEMBLY No 5NDSG2A | USED ON DSG2

CCT. DIA. REF.	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
Mains input socket				Corcom	VS/F6J4		TG6J4	Back panel
Mains lead				Cliff	22V2			
TX301	Mains transformer			Farnell	2SR0233		ZR0273	Chassis
SW1	Mains on/off switch			Farnell			SB0020	Front panel
LP1	Neon			BIM	SMC278HT		IN3RED	Front panel
F301	20X5	500mA	Fast	Beswick	TDC13		FF500M13	PCB
F302	20X5	500mA	Fast	Beswick	TDC13		FF500M13	PCB
F303	20X5	1.5A	Fast	Beswick	TDC13		FF1A5 013	PCB
F304	1¼ x ¼	500mA	A/S (T Type)	Beswick	TDC11		FT500M11	Back panel Mains input skt.
Meter				Farnell			EM0757129	Front panel
P1	5K0 amplitude			AB	Type 16	C	PC45K0016	Front panel
Sa1	50Ω output				UG1094/BQ		TR1094	Front panel
Terminals								
Red				Cliff	TP2		TM2 RED	Front panel
Black				Cliff	TP2		TM2 BLK	Front panel

CCT. DIA. REF.	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
PCB							BCU31	
R401	869R5	0.5W	0.25	Holsworthy	H4	MF	RM3869RH4	PCB
2	5R769						RM5R76RH4	
3	869R5	0.5W	0.25	Holsworthy	H4	MF	RM3869RH4	
4	436R2						RM3436RH4	
5	11R61						RM211R6H4	
6	436R2						RM3436RH4	
7	221R						RM3221RH4	
8	249R5						RM249R5H4	
9	221R						RM3221RH4	
10	116R1						RM3116RH4	
11	52R84						RM252R8H4	
12	116R1						RM3116RH4	
13	96R25						RM296R2H4	
14	71R15						RM271R1H4	
15	96R25						RM296R2H4	
16	61R11						RM261R1H4	
17	247R5						RM3247RH4	
18	61R11						RM261R1H4	
19	61R11						RM261R1H4	
20	247R5						RM3247RH4	
21	61R11						RM261R1H4	
22	61R11						RM261R1H4	
23	247R5						RM3247RH4	
24	611R11						RM261R1H4	
C401	15µF	40V	20	Mullard	015	E	CE215U0JM	
D401-407					1N4148		DG4148	
RL401-407		24V		Omron	G2V2		SRG2V2	

ISS	DATE	Q.C No.	CHECKED	SS	DATE	Q.C No	CHECKED

DRAWN

COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CE CERAMIC; E ELECTROLYTIC; PC POLYCARBONATE; PF POLYESTER FILM; PM POLYESTER METALIZED; PP POLYPROPELENE; PS POLYSTYRENE; SM SILVER MICA; T TANTALUM

RESISTORS: C CARBON; CF CARBON FILM; CM CERMET; MF METAL FILM; MG METAL GLAZE; MO METAL OXIDE; P PLASTIC; WW WIRE WOUND

POTENTIOMETERS: C CARBON; CM CERMET; P PLASTIC; WW WIRE WOUND

INTEGRATED CIRCUITS: CE CERAMIC; MC METAL CAN; P PLASTIC

FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Analogue and Attenuator Circuit diagram

DRAWING No 1SZX0160

SHEET 3 OF 3 SHEETS

3FICDRB1 GAF 4803/91

DRAWING No 2SZX-0159 | ASSEMBLY No 5.WDSG280 | USED ON DSG2

CCT DIA REF.	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF	LOCATION
PCB							BC034	
R501	68R					MF	RM568R0J25	
2	1kΩ	C.4W	2	Mullard	MR25	MF	RM41K025	
3	10M	"	"	"	"	CF	RC810M025	
4	6K2	"	"	"	"	MF	RM46K2025	
5	3K0	"	"	"	"	"	RM43K0025	
6	6K2	"	"	"	"	"	RM46K2025	
7	3K0	"	"	"	"	"	RM43K0025	
8	6K2	"	"	"	"	"	RM46K2025	
9	3K0	"	"	"	"	"	RM43K0025	
10	6K2	"	"	"	"	"	RM46K2025	
11	3K0	"	"	"	"	"	RM43K0025	
12	6K2	"	"	"	"	"	RM46K2025	
13	3K0	"	"	"	"	"	RM43K0025	
14	6K2	"	"	"	"	"	RM46K2025	
15	3K0	"	"	"	"	"	RM43K0025	
16	6K2	"	"	"	"	"	RM46K2025	
17	3K0	"	"	"	"	"	RM43K0025	
18	6K2	"	"	"	"	"	RM46K2025	
19	3K0	"	"	"	"	"	RM43K0025	
20	6K2	"	"	"	"	"	RM46K2025	
21	3K0	"	"	"	"	"	RM43K0025	
22	6K2	"	"	"	"	"	RM46K2025	
23	3K0	"	"	"	"	"	RM43K0025	
24	6K2	"	"	"	"	"	RM46K2025	
25	3K0	"	"	"	"	"	RM43K0025	
26	1K0	"	"	"	"	"	RM41K025	
27	22K	"	"	"	"	"	RM522K025	
28	22K	"	"	"	"	"	RM522K025	
29	22K	"	"	"	"	"	RM522K025	
30	22K	"	"	"	"	"	RM522K025	
31	22K	"	"	"	"	"	RM522K025	
32	4K7	"	"	"	"	"	RM44K7025	
33	4K7	"	"	"	"	"	RM44K7025	
34	6K2	"	"	"	"	"	RM46K2025	
35	3K0	"	"	"	"	"	RM43K0025	
36	6K2	"	"	"	"	"	RM46K2025	
37	3K0	"	"	"	"	"	RM43K0025	
38	150	"	"	"	"	"	RM3150R25	
39	4K7	"	"	"	"	"	RM44K7025	
40	6K8	"	"	"	"	"	RM46K8025	
41	4K7	"	"	"	"	"	RM44K7025	
42	4K7	"	"	"	"	"	RM44K7025	
43	4K7	"	"	"	"	"		

CCT. DIA. REF.	COMPONENT DESCRIPTION: VALUE	RATING	TOL%	MANUFACTURER	MANF REF	TYPE	FARNELL REF.	LOCATION
C501	10µ	25V	20	Mullard	015	E	CE210U0GM	
2	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
3	10µ	25V	20	Mullard	015	E	CE210U0GM	
4	15p	100V	10	Mullard	642	CE	CC215P0N642	
5	18p	"	"	"	"	"	CC218P0N642	
6	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
7	10n	"	"	"	"	"	"	
8	100p	100V	10	Mullard	642	CE	CC3100PN642	
9	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
10	10n	"	"	"	"	"	"	
11	1µ0L	10V	20	Mullard	016	E	CE3100U0M	
12	10µ	25V	20	"	015	E	CE210U0GM	
13	10n	100V	10	Wima	FKS2min	PF	CFS10K0N2M1N	
14	"	"	"	"	"	"	"	
15	"	"	"	"	"	"	"	
16	"	"	"	"	"	"	"	
17	"	"	"	"	"	"	"	
D501					IN4148		DG4148	
IC501				Signetics	HEF4011		VD4011HEF	
2				Texas	SN7404N		VD7404N	
3				Signetics	HEF4738VP		VD4738VP	
4				Texas	SN7404N		VD7404N	
5				Signetics	HEF40148		VD40148	
6				Texas	SN7438N		VD7438N	
7				Texas	SN74LS32N		VD74LS32N	
8					SN74LS00N		VD74LS00N	
9					SN74L00N		VD74L00N	
10				Texas	SN74123N		VD74123N	
11					SN74LS42N		VD74LS42N	
12					SN74LS90N		VD74LS90N	
13				Texas	SN74LS02N		VD74LS02N	
14				"	"		"	
15					SN74LS76N		VD74LS76N	
16					SN74LS42N		VD74LS42N	
17				Texas	SN74LS02N		VD74LS02N	
18				Texas	SN74LS02N		VD74LS02N	
XT501	1MHz				HC33U		VX1M00HC33U	
SW501				Erg	SDS6		SC6	
BLSSKT				Arnphenal	57-20240-2		TRS/2024OZ	Back Panel

SS	DATE	Q.C No	CHECKED	SS	DATE	Q.C No	CHECKED

DRAWN

COMPONENT TYPE ABBREVIATIONS

CAPACITORS: CE CERAMIC; E ELECTROLYTIC; PC POLYCARBONATE; PF POLYESTER FILM; PM POLYESTER METALIZED; PP POLYPROPELENE; PS POLYSTYRENE; SM SILVER MICA; T TANTALUM

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POTENTIOMETERS: C CARBON; CM CERMET; P PLASTIC; WW WIRE WOUND

INTEGRATED CIRCUITS: CE CERAMIC; MC METAL CAN; P PLASTIC

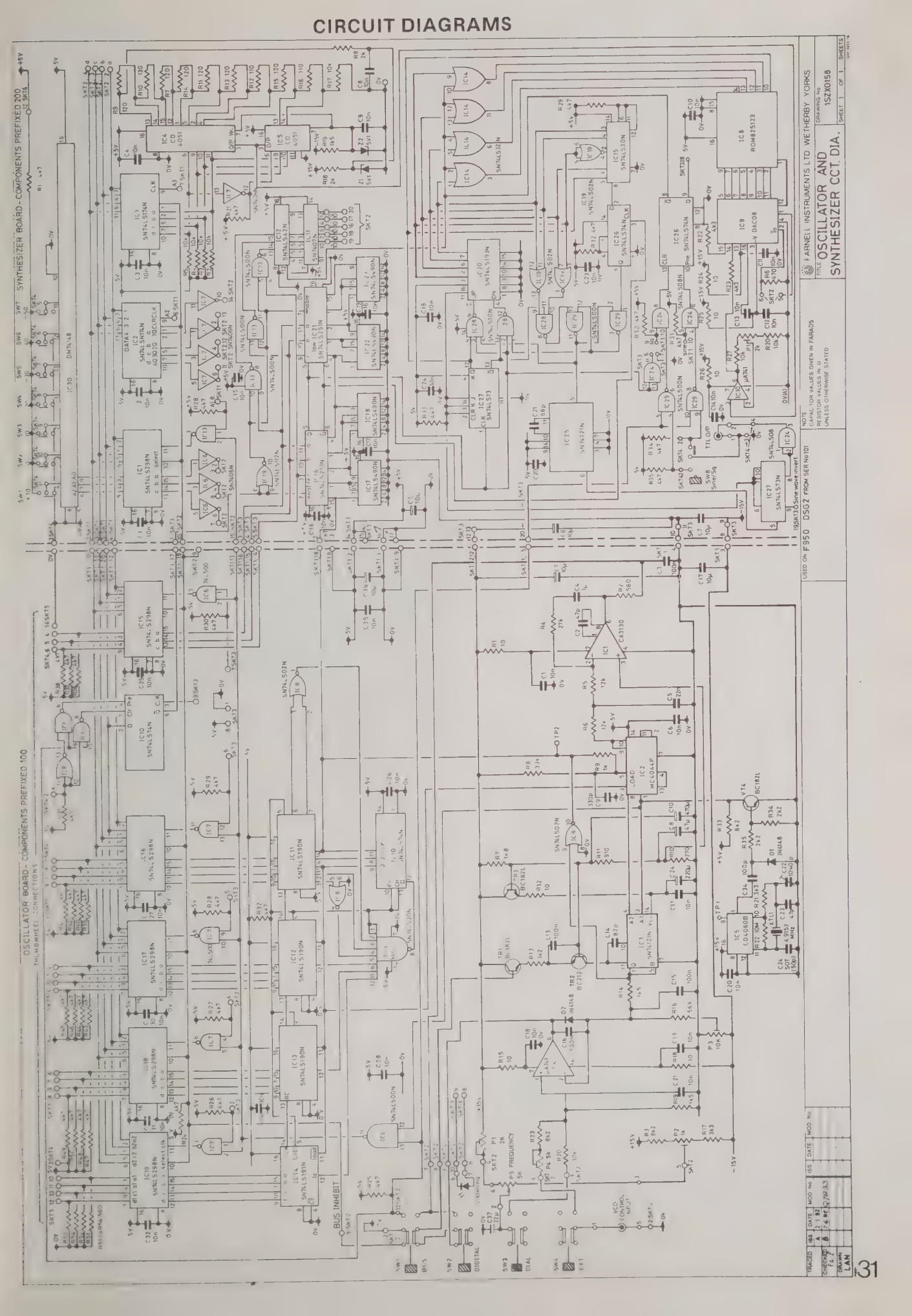
FARNELL INSTRUMENTS Ltd.
WETHERBY W YORKSHIRE LS22 4DH ENGLAND

TITLE REFERENCE SHEET FOR: Bus Board

DRAWING No 2SZX-0159

SHEET 1 OF 1 SHEETS

3FICDRB1


OSCILLATOR BOARD - COMPONENTS PREFIXED 100
THUMBWHEEL CONNECTIONS
SYNTHESIZER BOARD - COMPONENTS PREFIXED 200
F. ARNELL INSTRUMENTS LTD WETHERBY YORKS
TITLE OSCILLATOR AND SYNTHESIZER CCT. DIA.
DRAWING No 1SZX0158
SHEET 1 OF 1 SHEETS
USED ON F950 DS02 FROM SER No 101
NOTE CAPACITOR VALUES GIVEN IN FARADS
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED
BUS INHIBIT
DIGITAL
DIAL
EXT
VCO CONTROL INPUT
P1 2K FREQUENCY
P5 5K
P4 5K
P2 1K
P3 10K
IC1 CA3130
IC2 MC1044P
IC3 μA741
IC4 CD 4051
IC5 CD4060B
IC8 ROM8253123
IC9 DAC08
IC10 SN74LS74N
IC11 SN74LS190N
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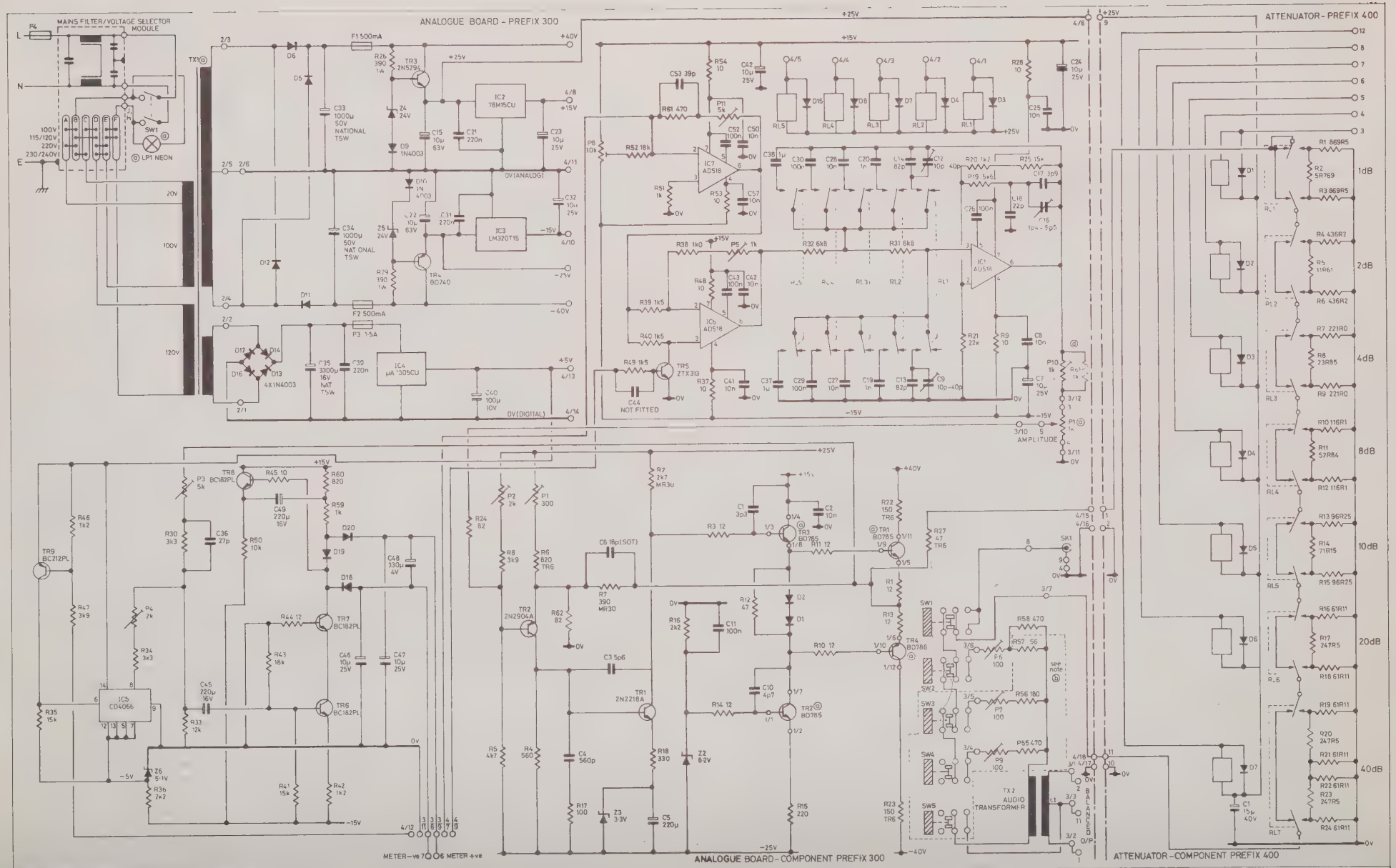


TRACED	ISS	DATE	MOD. NO.	ISS	DATE	MOD. NO.
CHECKED VG /	P1	12 1081				
DRAWN LAN	A	29 JUL 82				

(b) NOT FITTED ON F950 (DSG-2)
(c) NOT FITTED ON F5051
(d) COMPONENTS NOT BOARD MOUNTED (NO PREFIX). ALL DIODES ARE 1N4148 UNLESS OTHERWISE STATED.
3/7 SKT 3 PIN 7

(d) P10 FITTED ON SER Nos 51 to 75, R61 FITTED ON 101 ONWARDS.

USED ON F950 (DSG-2) SER Nos 101 ONWARDS. F5051

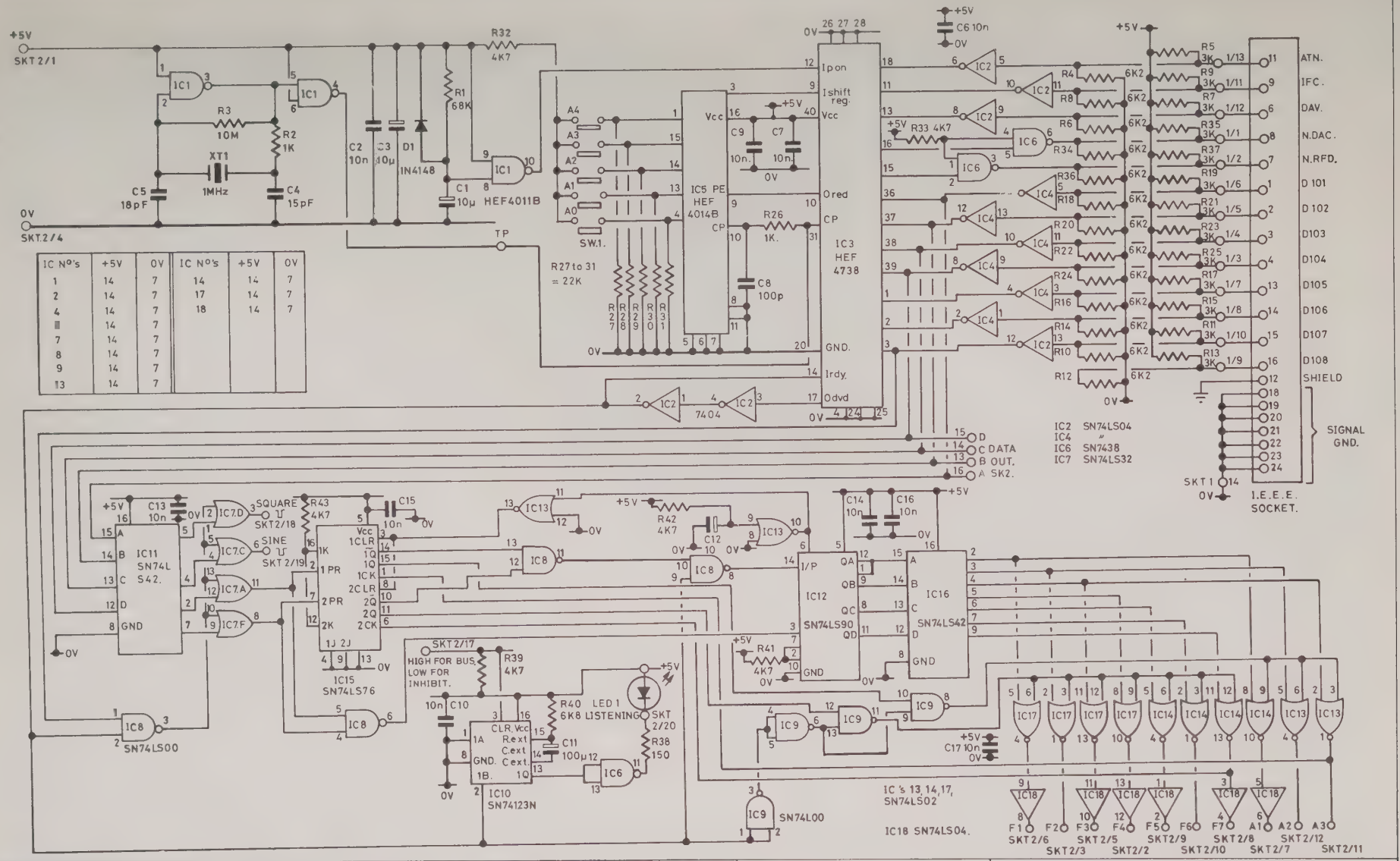
NOTE
CAPACITOR VALUES GIVEN IN FARADS
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED

FARNELL INSTRUMENTS LTD WETHERBY, YORKS

TITLE ANALOGUE AND ATTENUATOR CCT. DIA.

DRAWING No. 1SZX0160

SHEET 1 OF 1 SHEETS



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7	14	7			
8	14	7			
9	14	7			
13	14	7			

TRACED	ISS	DATE	MOD No	ISS	DATE	MOD No
	A	29-1-82				
CHECKED PdL	B	3.6.82	Q7833			
DRAWN LAN						

SOCKET NUMBERING – ○2/6 REFERS TO SOCKET 2, PIN 6.

USED ON F950
F5051

NOTE
CAPACITOR VALUES GIVEN IN FARADS
RESISTOR VALUES IN Ω
UNLESS OTHERWISE STATED
COMPONENTS PREFIXED 500

FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE BUS BOARD
CICUIT DIAGRAM DSG2

DRAWING No 2SZX/0159

SHEET 1 OF 1 SHEETS

NOTES

NOTES

MP MASTER
MA23411

FARNELL INSTRUMENTS LIMITED - SANDBECK WAY - WETHERBY - YORKSHIRE LS22 4DH - TELEPHONE 0937 61961